X-Band Radar:
More Than a Source for Airborne Weather

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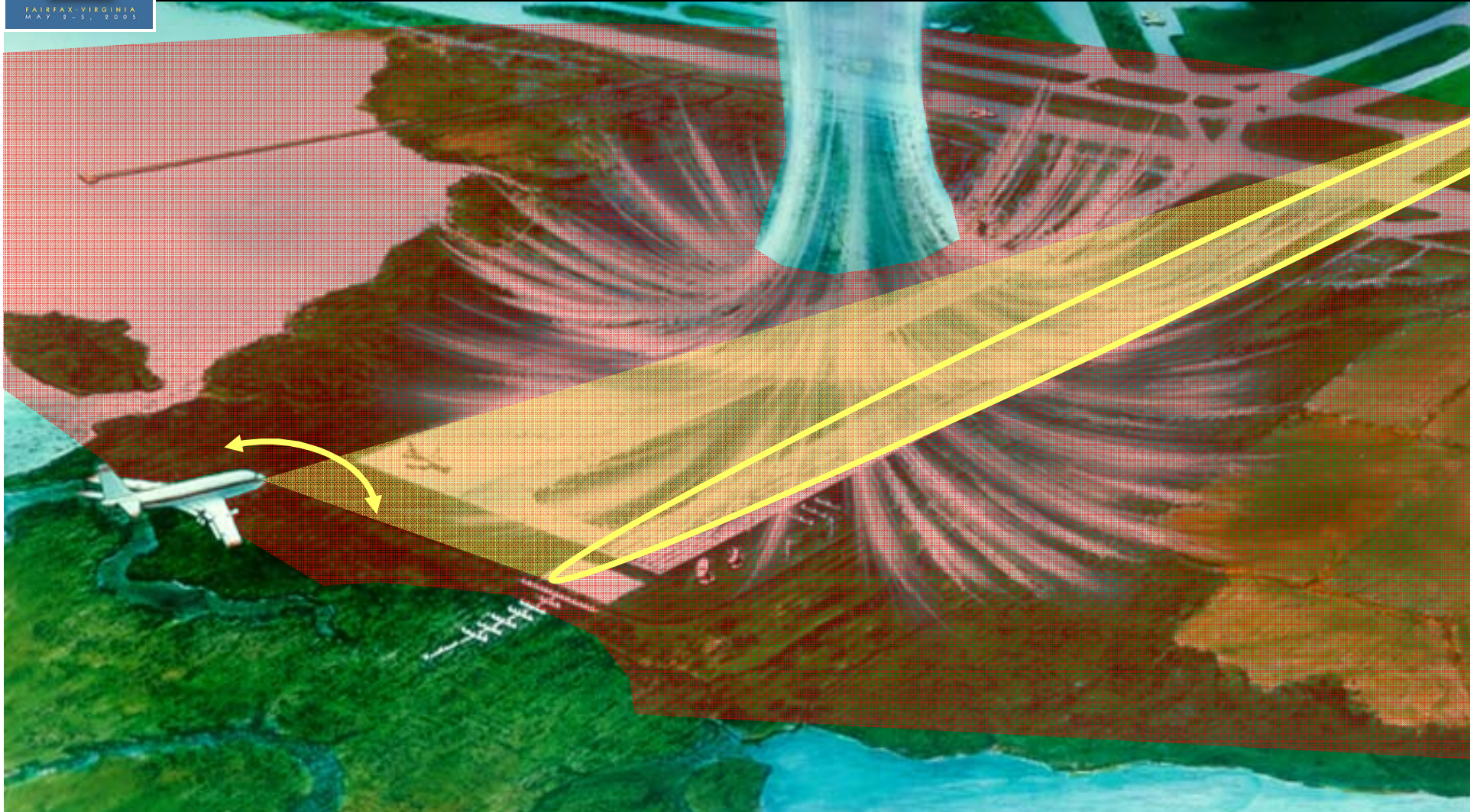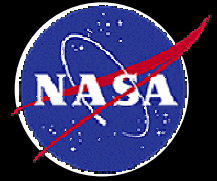757-864-1805
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Thursday 05 May 2005

Wind Shear Detection

Radar must look down onto the ground, spatially and temporally resolve wind field, separating weather signatures from ground clutter/signatures

Now installed on all large commercial (most military) transport aircraft, more than 8000 installations resulting in over $1B in revenues

TFE: Terrain Feature Extraction
Variety of implementations/displays, for SVC,
uses GPS Position and DTED to Confirm/Correct
Database Registration (ie, one form of DIME) &
Database Augmentation

NCAT: Non-Cooperative Aircraft Tracking
Developed under NASA HSR Program
Demonstrated Real-Time NCAT (1997/TIFS)

All-WX Taxi: Similar to RID but using taxiway templates and an ultra-short range radar mode Allows A/C to taxi to gate w/o GSR assistance

R/WI: Runway Confirmation
Uses Airport Characteristics (Approach Lights, Terminal Location, Runway Edges, etc) to Confirm/Correct Registration
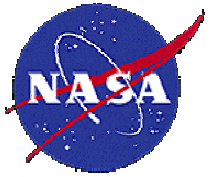
RID: Runway Incursion Detection
Using the known/measured runway location as a template we look for localized areas of significant NRCS contrast but alert ONLY on objects within the Runway template

Non-Cooperative Aircraft Tracking

Runway Confirmation & Runway Incursion Detection

HSR – XVS – RF Sensor Technologies

Develop/Integrate/Demonstrate RF Technologies which Enable the Development of A Commercially Viable Aircraft, Capable of Carrying 300 Passengers at Mach 2.5 over Trans-Pacific Routes, and at Operational Costs Comparable with Subsonic

Traffic Surveillance for a "No Forward Window Cockpit"
Maintain or Enhance Traffic/Terrain Awareness
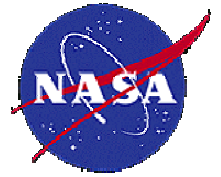*(including non-cooperative traffic)*

NCAT Video NASA Be-200

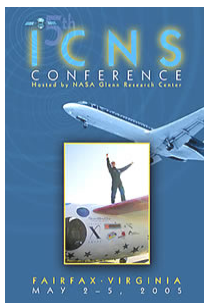# Non-Cooperative Aircraft Tracking Requirements

Range: ~4Nm (500kts & 30s) P_D: 90%

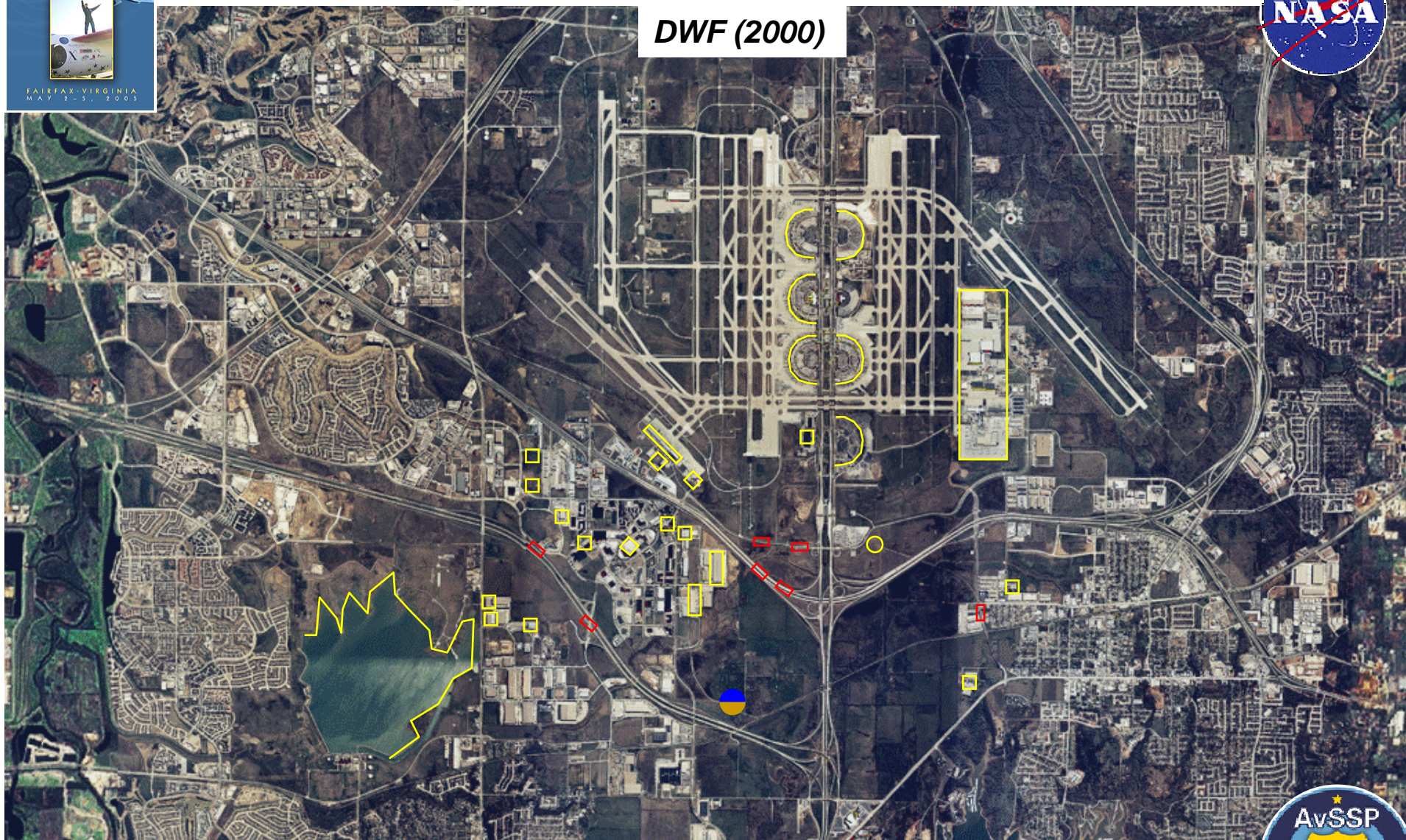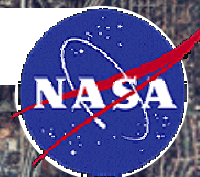**FoR**: $40°x50°$ (AxE)   **Update**: 8s (AAMT Augment: 10Hz)

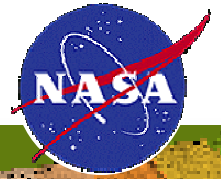# High-Resolution Radar Ground Map

DWF (2000)

Expected Features
Moving Traffic

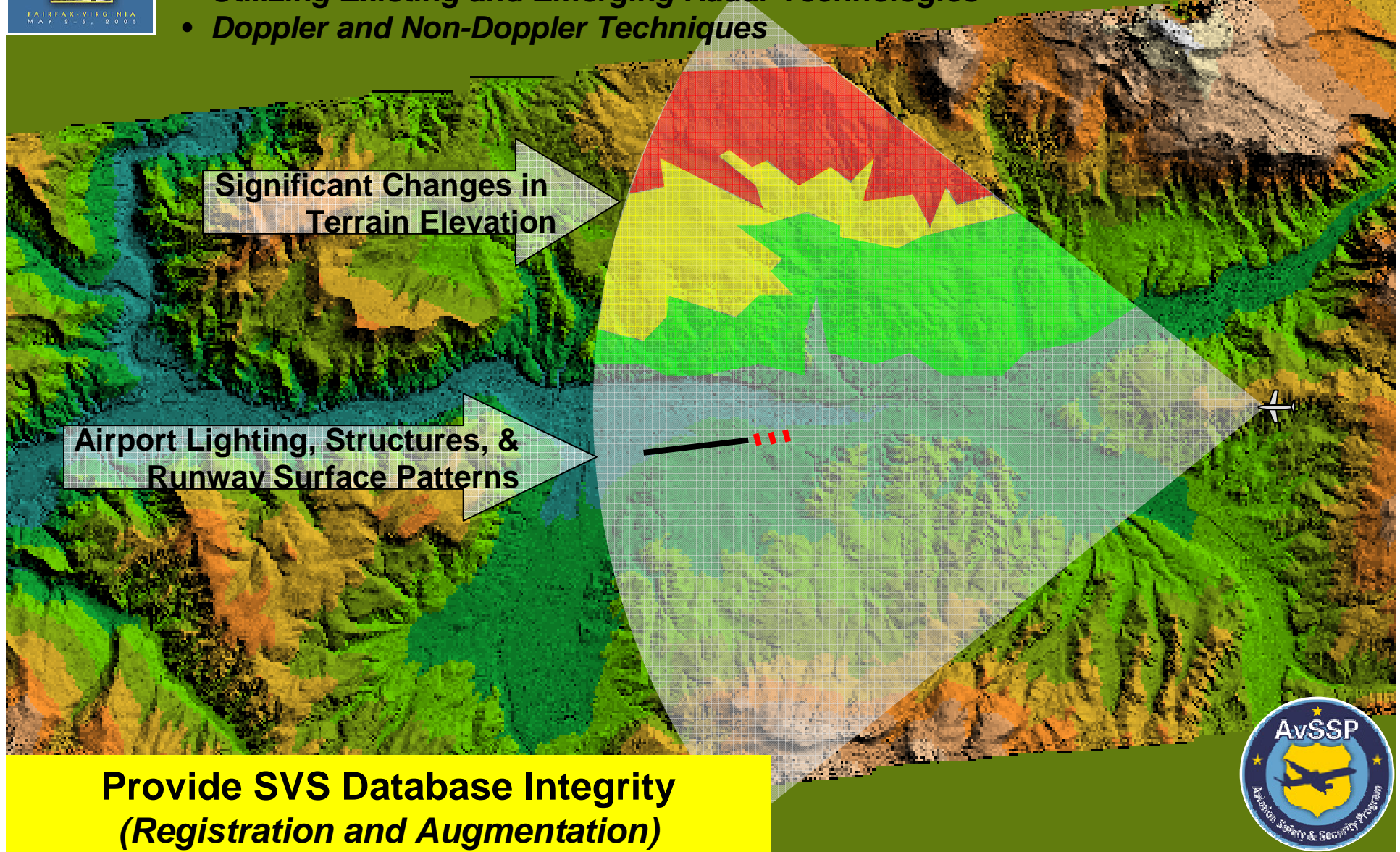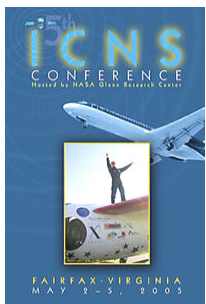Confirm Location of Airport Features
Urban / Man-Made Environment

Terrain Feature Extraction

- *Utilizing Existing and Emerging Radar Technologies*
- *Doppler and Non-Doppler Techniques*

Significant Changes in Terrain Elevation

Airport Lighting, Structures, & Runway Surface Patterns

Provide SVS Database Integrity
(Registration and Augmentation)

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Conventional WXR
150 m x +3° bins

Enhanced Vision Radar
3 m x 1/3° bins

LFI
NRCS
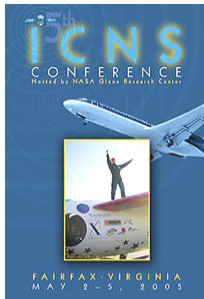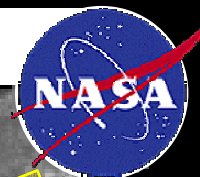
Course bins

Fine bins
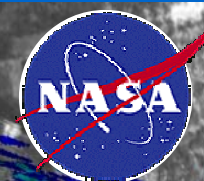
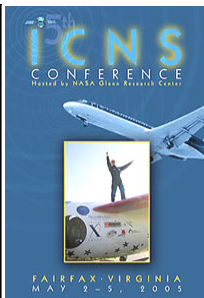Additional Resolution Allows for more Accurate Beam Fill & Therefore More Accurate Measurements

ICF Test Set-up – LFI (RW! & RID)

AvSSP-Synthetic Vision Project
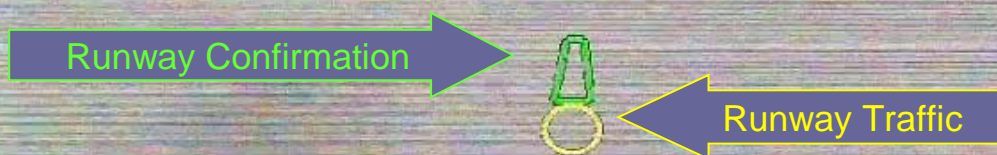## *Synthetic Vision Sensors Element*

Runway Confirmation & Incursion Detection

- May 2003 SVS ICF – NASA B757
- Near Instrument Meteorological Conditions
- Ceiling as Low as 200'
- Visibility < 1NM
- 20+ dBZ Rain (disables W-Band Radars)
- Video Start ~1.5NM or 35s from Runway Threshold (LFI)

Runway Confirmation →

← Runway Traffic

T-30s < Advisory Warning < T-60s
T-30s < Traffic Alert

AvSSP – Synthetic Vision Systems Project
Synthetic Vision Sensors Element

Airborne Object Detection
(Built from HSR Spin-Off)

Runway Confirmation &
Runway Incursion Detection
(DFW Data)

Terrain Awareness &
Database Registration
(EGE Data)

121

650

TLS

-600 VS

Verifies and Supplements SVS Concept Utilizing Existing EVS Technologies (Airborne Doppler Radar & FLIRs)

*Provides Incremental Technology Step Critical to SVS Deployment*

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Non-Cooperative Aircraft Tracking

DONE (HSR)
KC-135 ($400M⁺)
Pacer CRAG

**Runway Confirmation &
Runway Incursion Detection**

DONE (SVS)
RC & DoD

Synthetic Vision Sensor Technologies
**Integrating & Building Upon Existing
Airborne Doppler Radar & FLIR Technologies**

GAIN   WX   WX/TRB   MAP   TRFC   ANT
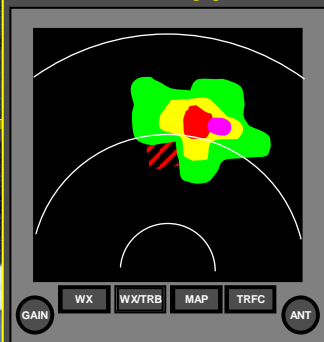
Ongoing
MaxViz &
NASA

**Terrain
Awareness**

50% (SVS)
AvSSP φ2

**All-Weather
Ground Operations**

AvSSP φ2

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